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Zhao et al.

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(54) **METHOD FOR CONDUCTING RADIATED PERFORMANCE TESTS OF A WIRELESS DEVICE**

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(51) **Int. Cl.**
H04Q 7/20 (2006.01)

(52) **U.S. Cl.** **455/423**; 455/424; 455/425; 455/67.11; 455/67.12; 455/67.14

(58) **Field of Classification Search** 455/418, 455/419, 420, 423, 424, 425, 67.11, 67.12, 455/67.15, 67.14

See application file for complete search history.

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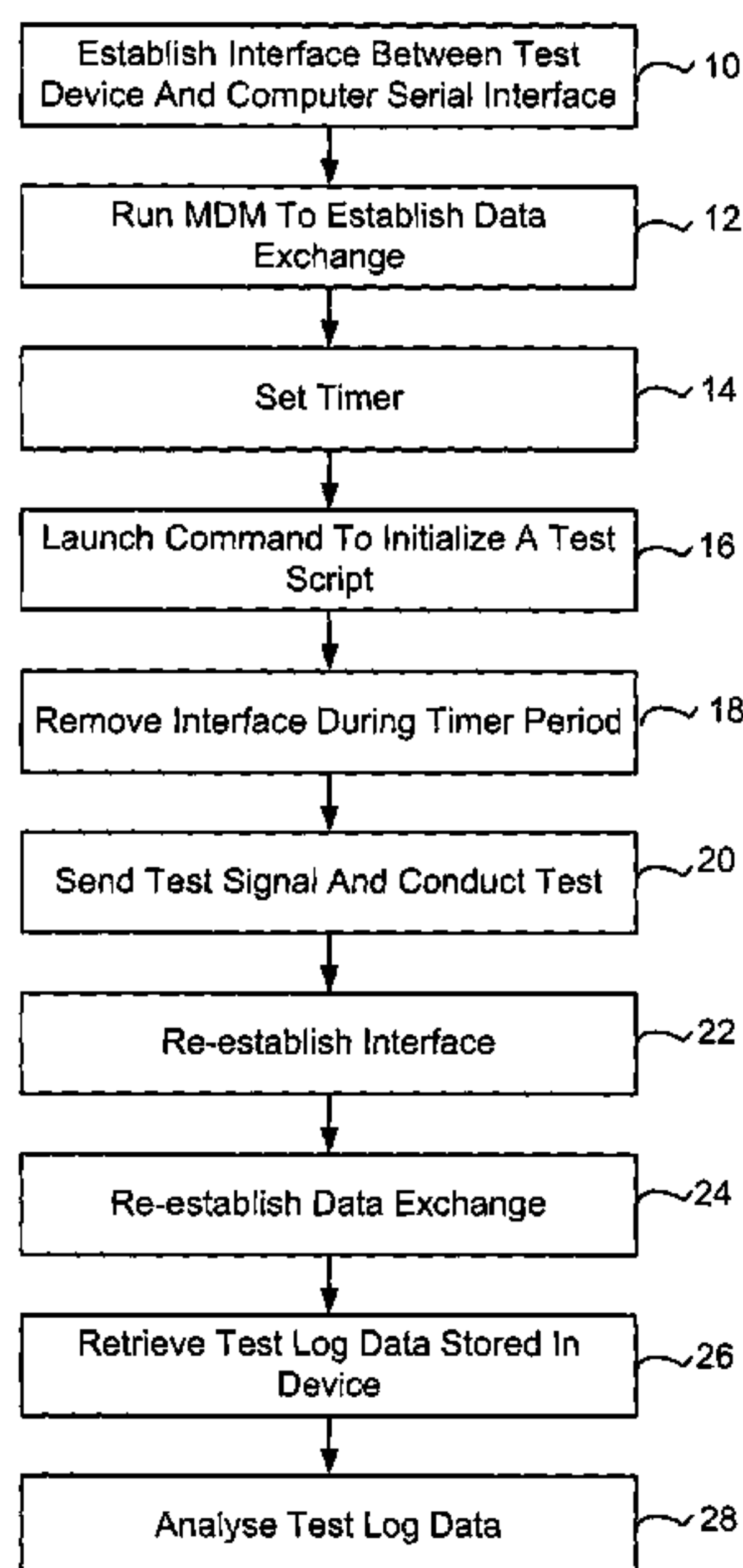
* cited by examiner

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(57) **ABSTRACT**

A method for conducting a radiated performance test on a wireless device comprising the steps of: establishing an interface from a test computer to the wireless device; establishing a data connection on the interface between the test computer and the wireless device; initializing and starting a timer for a predetermined interval on the wireless device; starting a test script on the wireless device; removing the interface during the predetermined interval; running the radiated performance test after the predetermined interval; storing a log of the radiated performance test on the wireless device; and analysing test results based on the log.

17 Claims, 3 Drawing Sheets



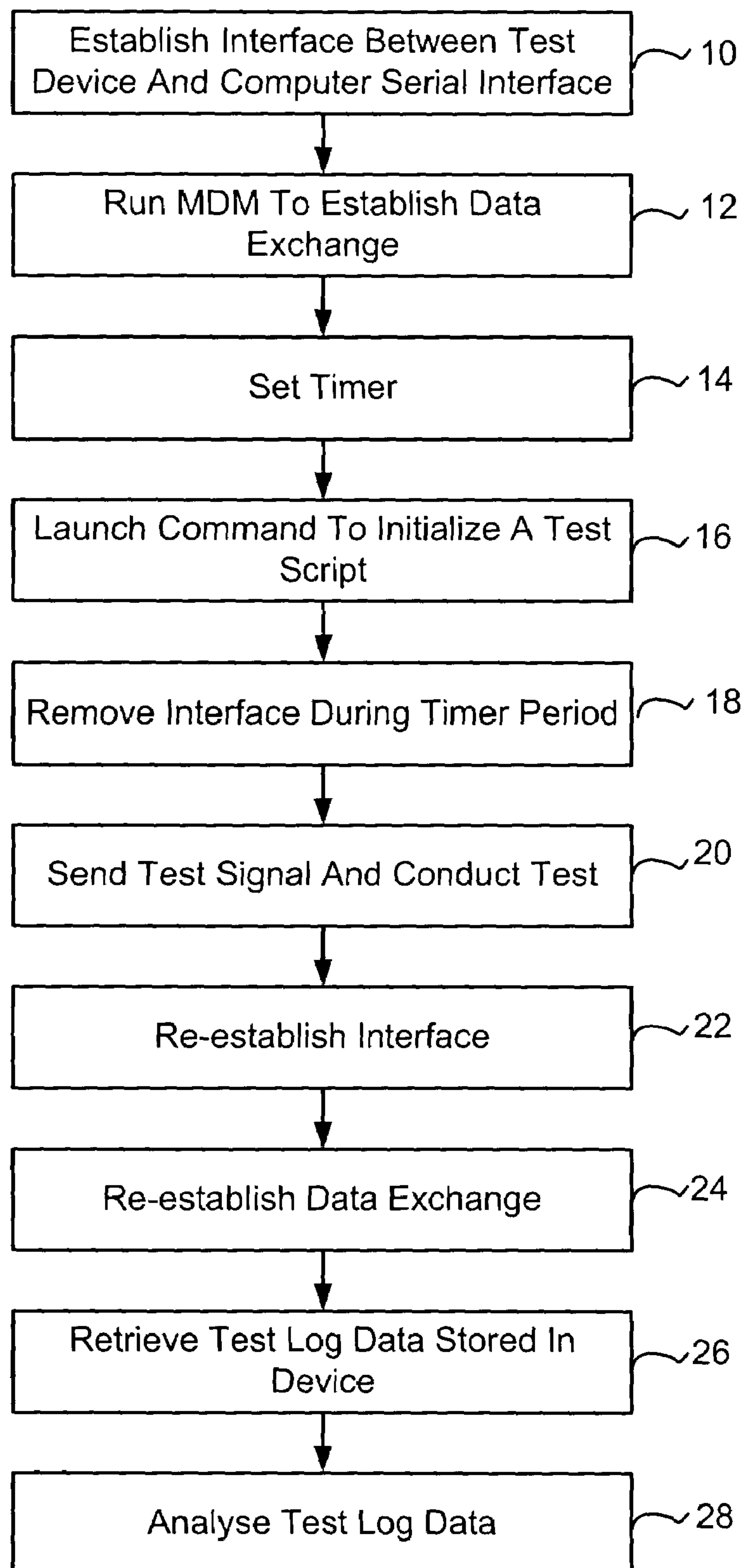


Figure 1

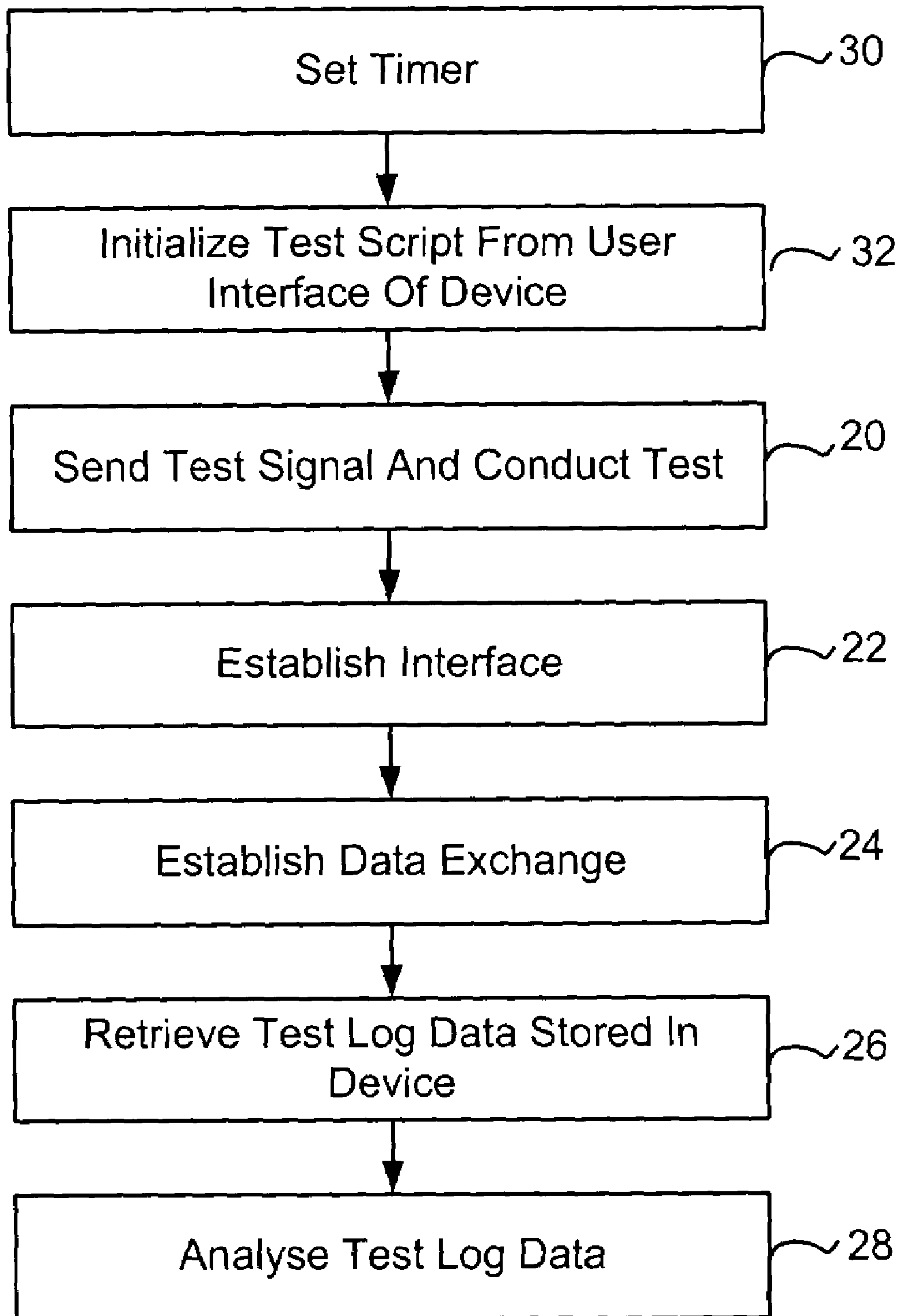


Figure 2

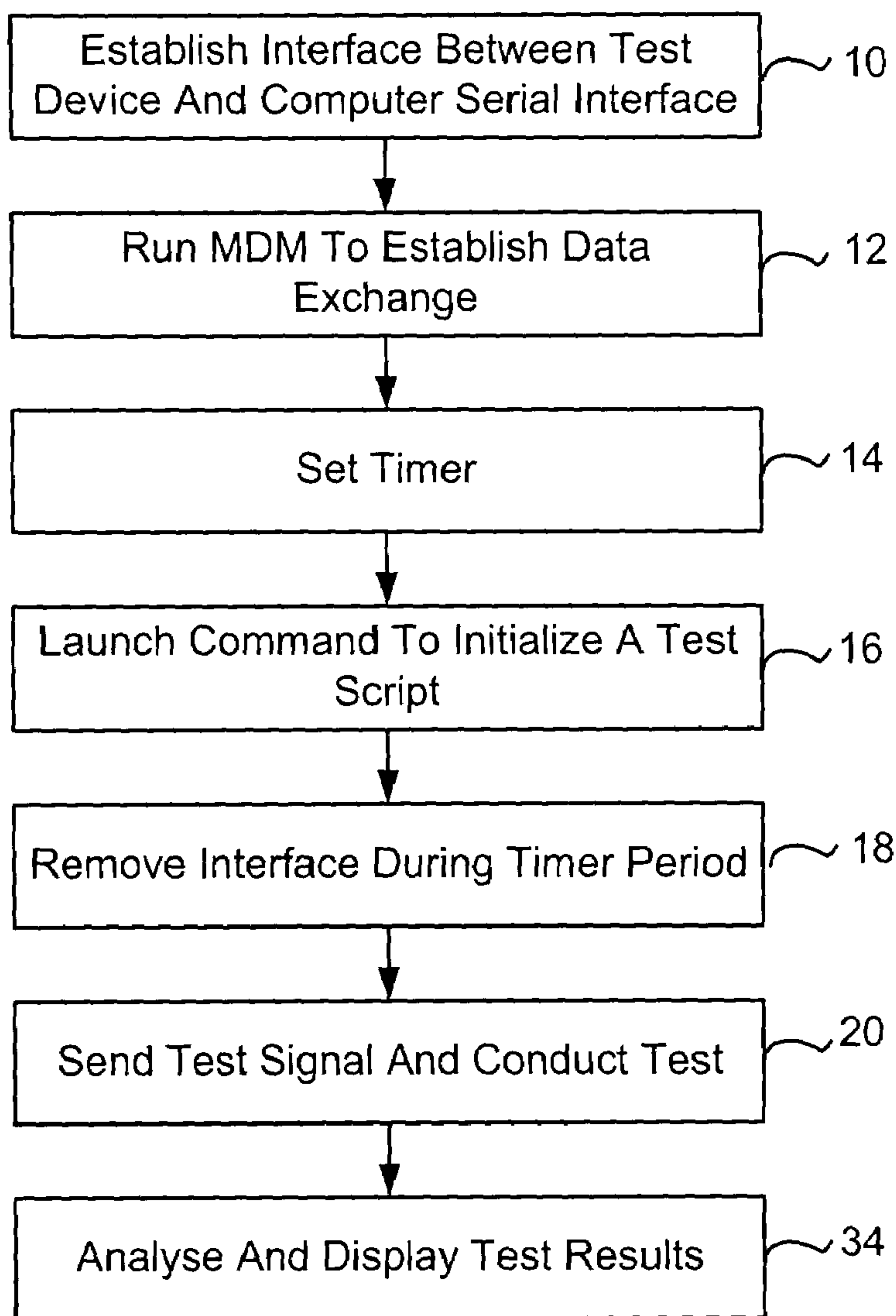


Figure 3

1**METHOD FOR CONDUCTING RADIATED
PERFORMANCE TESTS OF A WIRELESS
DEVICE**

FIELD OF THE INVENTION

The present invention relates to a method for conducting radiated performance tests, and in particular to a method for conducting radiated performance tests without disrupting the antenna pattern of a wireless device.

BACKGROUND TO THE INVENTION

The results of radiated performance tests, including sensitivity tests, of a wireless receiver in an anechoic chamber are strongly dependent on the antenna pattern. The antenna pattern can be altered if additional wires or cables are attached for test purposes but which do not exist under the normal operating conditions for the device. By attaching wires or cables for test purposes, the accuracy of the test results are affected.

Inaccuracies are also further caused by signals travelling along the wires or cables attached for test purposes. These signals generate interference that is radiated into the space around the receiver or are coupled through surrounding circuitry, and this interference or coupling may also affect the test accuracy.

If wireless means such as Bluetooth or IrDa are used instead of cable, the spurious emissions from a Bluetooth or IrDa transceiver may also cause interference that is radiated into the space around the receiver, affecting test accuracy. It is therefore desirable not to use wireless communications other than the test signal during testing.

In wireless devices that normally operate in two directions simultaneously, i.e. transmitting while receiving (either simultaneously in time or being time multiplexed), the transmitting channel can be used as a means to report the receiving performance values. These receiving performance values include bit error rate, frame error rate, block error rate, detection rate, or misdetection rate, false alarm rate, etc. In a device which operates in two directions, no attached wire or cable is necessary. Instead, such devices loop back data that is received or send messages in the transmit direction that report performance values.

For wireless devices that only operate in one direction at a time, or for testing operating modes that only use one direction, or for the type of test equipment that does not have the capability to obtain reported test messages over the air, or for prototypes that have limited test support functionality, other means of retrieving performance data from within the device are needed.

A current method of testing devices includes attaching a cable between the device under test and a computer through a serial interface. Test scripts, which are prepared in advance of the tests, are initiated from the computer and the contents are sent through the data cable to the device. Software on the device under test has the capability of accepting commands received through the data cable. The software further interprets the commands and acts according to these commands. The results of the actions are logged and these logs are sent back to the computer using the same data cable. These log results are further interpreted to obtain the results of the test. Since the data cable is attached to the device all the time during the test to maintain the communication between the device under test and the computer, the results of the test are tainted by the use of the cable.

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SUMMARY OF THE INVENTION

The present invention seeks to overcome the deficiency of the prior art by providing a method and apparatus for performing a test while a cable is not connected during the radiated test. The cable can be connected prior to the test and after the test to upload the test instructions and download the logged data respectively.

In one embodiment of the invention, a test cable is connected to the wireless device being tested. The test scripts are uploaded and pre-stored within the storage of the device. A command is sent by the test computer through the data cable to initiate the test script. This start test command also includes a delay of a predetermined length in which a tester can disconnect the cable, orient the device in its proper orientation, and close the door of the anechoic chamber before the test is allowed to run.

After the test is completed, the tester can reconnect the data cable and download test logs, which were stored on the device during the testing period. These logs can then be analysed to obtain the test results.

The present invention therefore provides a method for conducting a radiated performance test on a wireless device comprising the steps of: establishing an interface from a test computer to said wireless device; establishing a data connection on said interface between said test computer and said wireless device; initializing and starting a timer for a predetermined interval on said wireless device; starting a test script on said wireless device; removing said interface during said predetermined interval; running said radiated performance test after said predetermined interval; storing a log of said radiated performance test on said wireless device; and analysing test results based on said log.

The present invention further provides a method for conducting a radiated performance test on a wireless device comprising the steps of: initializing and starting a timer from said wireless device for a predetermined interval; starting a test script from said wireless device; running said radiated performance test after said predetermined interval; storing a log of said radiated performance test on said wireless device; establishing an interface between said wireless device and a test computer; establishing a data connection between said test computer and said wireless device; retrieving said test log from said wireless device to said test computer; and performing an analysis of said test log to provide test results.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a flow chart of the method of the present invention;

FIG. 2 is a flow chart of an alternative method; and

FIG. 3 is a flow chart of a third alternative method.

DETAILED DESCRIPTION OF THE DRAWINGS

Reference will now be made to the drawings.

FIG. 1 shows a preferred embodiment of the present invention. Commencing with the step identified by reference numeral 10, a data cable is connected between the device that is being tested and the test computer. Preferably, this cable is a serial cable that allows data flow in both directions between the test device and the computer conducting the test. One skilled in the art will however realize that other types of data cable or short range wireless communications means may also be used, and the examples below using a

serial cable are not meant to limit the invention. Such wireless communication means may include Bluetooth or IrDA.

The tester next moves to step **12**. In step **12**, data exchange is established between the test device and the computer. In a preferred embodiment, a software tool such as a mobile diagnostic monitor (MDM) is used. One skilled in the art will realize that other test tools are possible and reference to the use of the MDM is by way of example only. The MDM has the capability of sending commands to establish data exchange with the device through the data interface. It also has the ability to initialize test scripts and timers, to terminate data exchange and to send commands to receive test logs from the device.

Once data exchange has been established, the tester next moves to step **14**. In step **14**, the MDM is used to set a timer. The timer is set for a predetermined amount of time, for example 30 seconds.

The tester next moves to step **16** in which a command is used to initialize a test script. This test script is generally prepared in advance to program the actions and configurations of a test. Such actions include configuring test log settings, setting up a call, waiting for a settled receiver condition, configuring the receiver settings to the desired test condition, initializing the receiving session, and repeating the operation a predetermined number of times. Other functions of the test script will be known to those skilled in the art.

The next step **18** is performed during the timer period. In this step, data exchange is terminated, and the tester physically disconnects and removes the data cable from the device. If short range wireless communications are being used rather than a cable, the communications are stopped and the transceiver devices used to communicate with the wireless device under test are preferred to be moved out of the anechoic chamber. The device remains in the anechoic chamber in the desired position and orientation for the test and is ready to perform the received test. The door to the anechoic chamber is closed.

Moving to step **20**, a test signal is sent and the radiated test is conducted. The test signal can and in many instances should be radiated within the anechoic chamber in the desired configuration before the timer set in step **14** expires, and this signal should continue to radiate at the given configuration until the test finishes.

Continuing in step **20**, the device is receiving the test signal. Software on the device begins executing at the end of the timer period, and the device executes the test script. Data that is gathered from the test is stored in a test log within the device's storage.

At the end of the test period, the tester moves to step **22**. In step **22**, the door of the anechoic chamber is opened and the data cable is reconnected to the device under test. If short range wireless communication means are used, the wireless communication means are initiated rather than a cable being reconnected.

The tester next moves to step **24**. In step **24**, the MDM is run to re-establish the data exchange between the test device and the computer.

Moving on to step **26**, a command is sent from the MDM to the test device to retrieve the test log data that was stored in the device's storage during the test. This data is received at the computer.

In step **28**, the test log data is analysed to obtain the test results. The above method overcomes the disadvantages of the prior art by providing for testing without a data cable being attached. This ensures that the data cable does not

interfere with the antenna pattern of the device and therefore more accurate radiated test results are obtained.

Reference is now made to FIG. **2**. In FIG. **2**, the method of the test is shown in a flow chart with the steps common between the methods of FIG. **1** and FIG. **2** being identified using the same reference numerals. The principal difference between the methods of FIGS. **1** and **2** is the addition of steps **30** and **32**. Rather than setting the timer and launching the command to initialize a test script from the MDM, the method of FIG. **2** contemplates pre-storing a test script, and the timer and test script being initialized from the user interface of the device in steps **30** and **32** respectively. Such initialization could occur from the menu of the engineering section of the device instead of being launched by an MDM command.

The remainder of the steps in the alternative method shown in FIG. **2** are the same as the steps described above with reference to FIG. **1**.

In a further alternative embodiment, step **28**, in which the test log data is analysed by a test computer, is replaced by an analysis of the test results by the test device itself. This alternative can be accomplished using software running on the device that displays the test results on the user interface of the device. For example, a page on the engineering section can show the test results. In this alternative, steps **22** to **28** are replaced with step **34** as illustrated in FIG. **3**. One skilled in the art will realize that the alternative method of FIG. **3** can be combined with the method of FIG. **2**, thus utilizing steps **30** and **32** rather than steps **10** through **16** in FIG. **3**.

In yet another alternative, the MDM and software running in the device allow test scripts to be downloaded or recorded onto the device in step **14**. This saves the device's memory when the device is not performing the test, and allows flexibility to alter test scripts. The other parts of the methods of FIGS. **1** and **3** remain the same.

The above described embodiments of the present invention are meant to be illustrative of the preferred embodiments and are not intended to limit the scope of the present invention. Various modifications which would be readily apparent to one skilled in the art are intended to be within the scope of the present invention. The only limitations to the scope of the present invention are set forth in the following claims.

We claim:

1. A method for conducting a radiated performance test on a wireless device under controlled test conditions, the method comprising the steps of:

- establishing an interface from a test computer to said wireless device;
- establishing a data connection on said interface between said test computer and said wireless device;
- initializing and starting a timer for a predetermined interval on said wireless device;
- removing said interface to said wireless device during said predetermined interval;
- starting a radiated performance test result accumulation script at said wireless device after said predetermined interval;
- subjecting said wireless device to said radiated performance test after said predetermined interval;
- storing a log of said radiated performance test results on said wireless device; and
- analysing said test results based on said log.

2. The method of claim **1**, wherein said interface is a data cable.

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3. The method of claim 1, wherein said interface is a wireless communications means.

4. The method of claim 1, wherein analysing said results includes:

- re-establishing said interface;
- re-establishing said data connection between said test computer and said wireless device;
- retrieving said test log from said wireless device to said test computer; and
- performing an analysis of said test log to provide derived test results.

5. The method of claim 4, wherein said step of initializing a timer includes said software tool sending a command to said wireless device.

6. The method of claim 1, wherein analysing said test results includes:

- performing an analysis of said log on said wireless device to obtain derived test results; and
- displaying said test results on said wireless device.

7. The method of claim 1, wherein said computer includes a software tool for communications between said wireless device and said computer.

8. The method of claim 7, wherein said step of establishing said data connection includes said software tool sending a command to said wireless device.

9. The method of claim 7, wherein said step of starting a test script includes said software tool sending a command to said wireless device.

10. The method of claim 1, wherein said step of starting a test script further includes loading a test script from said computer to said wireless device.

11. The method of claim 1, wherein said test script pre-exists on said wireless device.

12. A method for conducting a radiated performance test on a wireless device under controlled test conditions, the method comprising the steps of:

- initializing and starting a timer from said wireless device for a predetermined interval;
- starting a radiated performance test result accumulation script from said wireless device after said predetermined interval;

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subjecting said wireless device to said radiated performance test after said predetermined interval;

storing a log of said radiated performance test results on said wireless device;

establishing an interface between said wireless device and a test computer;

establishing a data connection between said test computer and said wireless device;

retrieving said test log from said wireless device to said test computer; and

performing an analysis of said test log to provide derived test results.

13. The method of claim 12, wherein said interface is a data cable.

14. The method of claim 12, wherein said interface is a wireless communications means.

15. The method of claim 12, wherein said computer includes a software tool for communications between said wireless device and said computer.

16. The method of claim 15, wherein said step of establishing said data connection includes said software tool sending a command to said wireless device.

17. A method for conducting a radiated performance test on a wireless device under controlled test conditions, the method comprising the steps of:

initializing and starting a timer from said wireless device for a predetermined interval;

starting a radiated performance test result accumulation script from said wireless device after said predetermined interval;

subjecting said wireless device to said radiated performance test after said predetermined interval;

storing a log of said radiated performance test results on said wireless device;

performing an analysis of said log on said wireless device to obtain derived test results; and

displaying said test results on said wireless device.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 7,359,701 B2
APPLICATION NO. : 10/663591
DATED : April 15, 2008
INVENTOR(S) : Wen Zhao et al.

Page 1 of 1

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In column 5, line 3 in Claim 4, add --test-- between "said" and "results"; column 5, line 29 and line 32 in Claim 10 and Claim 11, change the method of claim 1 "." to --,--;

Signed and Sealed this

Eighth Day of July, 2008

A handwritten signature in black ink that reads "Jon W. Dudas". The signature is written in a cursive style with a large, looped initial "J".

JON W. DUDAS

Director of the United States Patent and Trademark Office